Climate Change and Food Security

For Prelims: Climate Change and Food Security, Western Disturbance, El Niño Southern Oscillation (ENSO), Indian Ocean Dipole (IOD).

For Mains: Impact of Climate Change and Food Security.

Source: TH

Why in News?

In 2023, India experienced a series of disruptive weather and climate phenomena, highlighting the intricacies of its precipitation system, impacting the **Food Security.**

How have been the Weather and Climate Phenomena?

- **Western Disturbance:**
  - The **Western Disturbance** traditionally brings vital moisture from European seas to the western Himalayas and parts of northern India in the winter and spring.
  - In 2023, the Western disturbance **persisted late into the summer,** complicating the transition to the Southwest Monsoon season. This unusual behavior raised concerns about its effects on precipitation patterns.
  - Climate-linked warming is likely to weaken winter precipitation from the Western disturbance and shift it to more intense rain events.
- **El Niño and IOD:**
  - An El Niño phase of the **El Niño Southern Oscillation (ENSO)** was intensifying, which can **adversely affect the southwest monsoon.**
    - While **not all El Niño events negatively impact the monsoon** due to its complexity, the dynamics between El Niño and the **monsoon are evolving.**
    - The **Indian Ocean Dipole (IOD)** can balance the **adverse impact of the El Nino on the South West Monsoon.**
    - Dynamic regression models indicate that 65% of the inter-annual variability in the southwest monsoon is attributed to the **combined effects of ENSO and the IOD**.
    - Some Studies have **found that 43% of heavy rainfall events** in the Northeast Monsoon coincided with **an El Niño.**

How Can Such Climate Phenomena Impact Agriculture and Water Resources?

- **El Niño's Effects on Green Water:**
  - Agriculture relies on two types of **water - green water from rain-fed soil moisture and blue water from rivers, lakes, reservoirs, and groundwater** for irrigation. Both are vital for food security.
  - Climate phenomena like **El Niño can disrupt rainfed agriculture**, affecting sowing, plant growth, and soil moisture.
  - Despite investments in irrigation infrastructure, around **half of India's cultivated area**

depends on green water, underscoring the significance of rainfed agriculture for food security.
    - **Contributions of green water from the monsoon and the Western disturbance** play significant roles in **preserving blue water stock** and groundwater to determine the **fate of the** Rabi Crops **sown in winter** and the overall water security.
- **El Niño's Effects on Crop Vulnerability:**
    - Even in irrigated areas, **crops like rice paddy, soybean, tur dal, groundnut, and maize rely on green water,** making them vulnerable to climate variability. For instance, **soybean production saw a 28% decline during the 2015-2016 El Niño year.**

How are the Emerging Climate Hotspots in India Impacted by Declining Monsoon Precipitation?

- **Water Stress in Central India:**
    - Certain regions in **Central India are emerging as climate change hotspots** with critical implications for water, food, and ecological security.
    - Persistent water stress and urban centers facing water shortages pose challenges.
- **Declining Monsoon Precipitation:**
    - Monsoon precipitation has been declining since the 1950s, potentially due to **reduced land-sea thermal gradients** due to the warming of the seas.
    - However, increasing intensity of rain events and heat stress are observed, adding complexity.
- **Model Uncertainties:**
    - Global climate models struggle to simulate observed precipitation trends, creating uncertainties in future projections. Climate scientists are working to improve these models.

What can be the Adaptation and Mitigation Strategies?

- **Shift to Less Water-Intensive Crops:**
    - Reducing dependence on water-intensive crops in favor of **less water-intensive crops like millets can enhance food system resilience** to phenomena like El Niño.
    - Shifting crops may **save 30% of blue water,** but policies are needed to prevent new demands for the saved water.
- **Alternative Crop Strategies:**
    - Encouraging farmers to adopt shorter-growing-cycle crops and diversify agricultural practices.
- **Improved Forecasting:**
    - Utilizing forecasts of climate phenomena like El Niño for informed decision-making.
- **Water Storage Management:**
    - Effective management of dams and reservoirs is crucial to reduce **flood risks and ecological damage.**

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. La Nina is suspected to have caused recent floods in Australia. How is La Nina different from El Nino? (2011)

1. La Nina is characterised by an usually cold ocean temperature in equatorial Indian Ocean whereas El Nino is characterised by unusually warm ocean temperature in the equatorial Pacific Ocean.
2. El Nino has adverse effect on south-west monsoon of India but La Nina has no effect on monsoon climate.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only

(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: D

Q. The scientific view is that the increase in global temperature should not exceed 2°C above preindustrial level. If the global temperature increases beyond 3°C above the pre-industrial level, what can be its possible impact/impacts on the world? (2014)

1. Terrestrial biosphere tends toward a net carbon source.
2. Widespread coral mortality will occur.
3. All the global wetlands will permanently disappear.
4. Cultivation of cereals will not be possible anywhere in the world.

Select the correct answer using the code given below:

(a) 1 only
(b) 1 and 2 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

Ans: (b)

Q. Which of the following pairs of crops are considered to be water intensive?

A) Wheat and rice
B) Wheat and sugarcane
C) Sugarcane and rice
D) Wheat and gram

Ans: C)

Mains:

Q. 'Climate change' is a global problem. How India will be affected by climate change? How Himalayan and coastal states of India will be affected by climate change? **(2017)**